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Masao Moriguchi

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SHARP LABORATORIES OF AMERICA, INC.
C/O LAW OFFICE OF GERALD MALISZEWSKI
P.O. BOX 270829
SAN DIEGO, CA 92198-2829

EXAMINER

PADGETT, MARIANNE L

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MASAO MORIGUCHI and
APOSTOLOS T. VOUTSAS

Appeal 2010-008958
Application 10/602,266
Technology Center 1700

Before EDWARD C. KIMLIN, CHUNG K. PAK, and CATHERINE Q.
TIMM, *Administrative Patent Judges*.

KIMLIN, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal from the final rejection of claims 1, 3-21, 23, 25-44,
and 65-66. We have jurisdiction under 35 U.S.C. § 6(b).

Claims 1 and 65 are illustrative:

1. A method for producing polycrystalline silicon, the method
comprising:

forming a film of amorphous silicon;

using a 2N-shot laser irradiation process to form polycrystalline silicon in a first area of the film, where the film is exposed to a series of 2-shot laser irradiation steps, where N is greater than 1 and equal to the number of steps, and where for each step, the direction of lateral growth is rotated 90° with respect to the previous step;

selecting a second area, included in the first area;

using a directional solidification (DS) process to anneal the second area;

wherein exposing the film to a series of 2-shot laser irradiation steps includes:

in a first step, projecting a first laser beam through a first aperture pattern oriented in a first direction with respect to the film; and,

in a second step, projecting the first laser beam through a second aperture pattern oriented in a second direction, orthogonal to the first direction, without rotating the silicon film, and without rotating the aperture patterns.

65. A method for laterally growing crystal grains in predetermined areas of a previously annealed silicon film, the method comprising:

in a first area of a silicon film, forming polycrystalline silicon having a plurality of parallel grain boundaries oriented in the first direction, and a plurality of parallel boundaries oriented in the second direction, orthogonal to the first direction;

using a directional solidification (DS) annealing process, sequentially annealing a second area defined by a pair of grain boundaries oriented in the first direction, intersecting a pair of grain boundaries oriented in the second direction; and,

in response to the DS annealing, laterally growing crystal grains in the second area.

The Examiner relies upon the following references as evidence of obviousness (Ans. 5):

Yamasaki	5,894,137	Apr. 13, 1999
Im	6,368,945 B1	Apr. 9, 2002
Kawasaki	6,653,657 B2	Nov. 25, 2003
Fukunaga	2004/0142543 A1	Jul. 22, 2004
Sposili '835	6,908,835 B2	Jun. 21, 2005
Sposili '954	WO 02/086954 A1	Oct. 31, 2002

Appellants' claimed invention is directed to a method for producing polycrystalline silicon in a film comprising amorphous silicon. The method employs a 2N-shot laser irradiation process to form polycrystalline silicon in a first area of the amorphous film, wherein for each exposure step the direction of lateral growth is rotated 90° with respect to the previous step. A first laser beam is projected in the first step through a first aperture pattern that is oriented in a first direction and, in a second step, the laser beam is projected through a second aperture pattern oriented in a second direction which is orthogonal to the first direction. The second, orthogonal direction is effected without rotating the silicon film and without rotating the aperture patterns. A directional solidification (DS) process is then used to anneal a second area within the first area.

The appealed claims stand rejected under 35 U.S.C. § 112 as follows:

- (a) claims 25-38, 65, and 66 under § 112, second paragraph,
- (b) claims 65 and 66 under § 112, first paragraph, enablement requirement,
- (c) claims 65 and 66 under § 112, first paragraph, written description requirement,

(d) claims 25-38 under § 112, first paragraph, enablement requirement,

(e) claims 1, 3-21, 23 and 25-44 under § 112, first paragraph, written description requirement.

All the appealed claims stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sposili in view of Yamazaki, and Fukunaga or Kawasaki.

We have thoroughly reviewed the respective positions advanced by Appellants and the Examiner in deciding that the Examiner's decision to reject the appealed claims is well founded. We agree, for essentially those reasons expressed in the Answer, that the claimed subject matter would have been obvious to one of ordinary skill in the art within the meaning of § 103 in view of the applied prior art. Concerning the § 112 rejections, however, we will only sustain the rejections set forth in paragraph (e) above.

We consider first the rejection of claims 25-38, 65 and 66 under § 112, second paragraph. It is by now well settled that claim language is not to be read in a vacuum but in light of the Specification as it would be by one of ordinary skill in the art. While the Examiner maintains that the claim language "annealing the first area in response to the first and second energy densities" has multiple possible meanings, we agree with Appellants that one of ordinary skill in the art would reasonably understand that the annealing occurs in response to the exposure to two energy densities. Regarding claim 65, we also agree with Appellants that one of ordinary skill in the art would reasonably understand that the lateral growth of crystal grains in the second area is the result of DS annealing.

We also concur with Appellants that the Examiner has not reasonably established that one of ordinary skill in the art would be unable to carry out

the method recited in claims 65 and 66 in view of the supporting Specification. The Examiner states that claim 65 recites unlimited or unspecified microstructures, but Appellants point out that the Specification explains that Figures 5, 6, 8, 10, 12, and 13 depict a film area having the recited orthogonal grain boundaries. It should borne in mind that it is not the function of the claims to exclude possible inoperative embodiments. *In re Dinh-Nguyen*, 492 F.2d 856, 858-59 (CCPA 1974); *In re Kamal*, 398 F.2d 867, 872 (CCPA 1968); *In re Sarett*, 327 F.2d 1005, 1019 (CCPA 1964). For essentially the same reason, we will not sustain the Examiner's rejection of claims 65 and 66 under § 112, first paragraph, written description requirement. The claims do not run afoul of the written description requirement simply because it is possible to broadly interpret the claims in a way that is not described in the Specification. Again, claim language must be read in light of the Specification as it would be by one of ordinary skill in the art.

We further agree with Appellants that the Examiner's rejection of claims 25-38 under § 112, first paragraph, enablement requirement, is not sustainable. The Examiner has not established that one of ordinary skill in the art would be unable to practice the various combination of steps set forth in the flow chart of Figure 14. As pointed out by Appellants, the Examiner has pointed to no contradictions in the Figure when it is read in light of the context of the present Specification. We point out again that it is not the function of the claims to specifically exclude possible inoperative embodiments that may be gleaned from the flow chart.

We will sustain the Examiner's rejection of claims 1, 3-21, 23, and 25-44 under § 112, first paragraph, written description requirement. We

agree with the Examiner that Appellants have not established that they had possession, at the time of filing the present application, of the concept of projecting the first laser beam through a second aperture pattern oriented in a second direction orthogonal to the first direction “without rotating the aperture patterns”. The Specification states that the process uses either beam-shaping masks or scanning schemes which either rotate the substrate or rotate the laser beam (p. 6, ll. 12-17). While Appellants maintain that “[c]laim 1 is written to recite the limitation of a mask with orthogonal apertures, while explicitly excluding other means that are mentioned in the Specification” (Br. 16, first para.), Appellants have not refuted the Examiner’s finding that the Specification fails to disclose any single mask having orthogonal apertures. While it may be possible to perform the claim process comprising orthogonal exposures by means other than rotating the substrate or mask, such as by using a single mask or two masks having orthogonal apertures, use of the later means is speculative and not described in the present Specification. Hence, in the absence of means other than rotating the silicon film or rotating the aperture patterns, we agree with the Examiner that there is not original descriptive support for the claimed negative limitation.

We will also sustain the Examiner’s § 103 rejection. There is no dispute that Sposili discloses a process for producing polycrystalline silicon by rotating the substrate 90° while performing the equivalent of Appellants’ 2N-shot laser irradiation process, i.e., sequential lateral solidification (SLS). Appellants contend that “none of the references disclose[sic, discloses] a 2N-shot process that is conducted without rotating either the substrate or the mask” (Br. 18, last para.). However, we fully concur with the Examiner that

it would have been obvious for one of ordinary skill in the art to rotate the substrate, or the mask, or to use a mask or masks having orthogonal apertures. As pointed out by the Examiner, the appealed claims and the Specification do not recite using a mask having orthogonal apertures, and we find no merit in Appellants' argument that hindsight reconstruction is necessary to find that it would have been a matter of obviousness for one of ordinary skill in the art to either rotate a mask orthogonally or to use a mask having orthogonal apertures. As for Appellants' argument that "none of the references disclose[sic, discloses] a DS process that is performed on selected regions of a previously annealed polycrystalline film with grain boundaries" (*id.*), Appellants have not refuted the Examiner's findings set forth at page 20 of the Answer, citing columns 22 and 24 of Sposili.

As a final point, we note that Appellants base no argument on evidence of unexpected results associated with processes within the scope of the appealed claims vis-à-vis the process disclosed by Sposili. Furthermore, it would appear from Appellants' Specification that the claimed SLS process and directional solidification process (DS) were known in the art, and Appellants have not demonstrated that the claimed invention produces anything other than what would have been expected by combining known processes.

In conclusion, based on the foregoing, the Examiner's decision rejecting the appealed claims is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. §1.136(a)(1)(iv).

AFFIRMED

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